REMARKS

Claims 1, 9-11, 19-22 were pending in the application. In the Office Action mailed July 14, 2011, claims 1, 9-11, 19-22 are rejected. In the instant Amendment, claims 1 and 9 have been amended to correct minor informalities and a grammatical error and new claims 23 and 24 have been added.

Claim 1 has been further amended to recite 0.18% aluminum. Support for this amendment is found in the specification, e.g., at page 27, Table 1, Steel E.

Support for new claim 23 is found in the specification at page 27, Table 1, steel F and in original claim 5.

Support for new claim 24 is found in the specification at page 41, Table 11, steel F and in original claim 6.

No new matter has been added by these amendments. Entry of the foregoing amendment and consideration of the following remarks are respectfully requested.

Claim Objections

Claims 1 and 9 are objected to by the Examiner for the informality of including ellipses preceding the equation number. Applicants have deleted the ellipses as suggested by the Examiner, thereby obviating the claim objections.

Rejections Under 35 U.S.C. § 112

Claims 1 and 9 are rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Applicants have amended the claims in the manner suggested by the Examiner and Claims 1 and 9 now recite "a structure comprising..." Applicants believe that the rejection is obviated by the claim amendments.

Rejections Under 35 U.S.C. § 103

Claims 1, 9-11, and 19-22 are rejected under 35 U.S.C. § 103(a) as being unpatentable over JP2001-342543 to Tsutomu ("JP'543") evidenced by US 6,364,968 to Yasuhara et al.

("US'968") in view of U.S. Patent No. 5,470,529 to Nomura et al. ("US'529") for reasons stated in the Non-Final Office Action date December 1, 2010 ("the December Office Action").

The presently claimed invention is directed to steel sheets having alloy compositions including both Al and Mg and achieving superior hole expandability, elongation, tensile strength, and chemical compatibility. Claims 1, 19, 21 and 23 are directed to steel sheets having a primarily bainite microstructure and claims 9-11, 20, 22 and 24 are directed to steel sheets having a primarily ferrite + bainite microstructure.

As discussed in the Declaration, test data disclosed in the instant application support the criticality of controlling the alloy contents, the relative amounts of alloy elements in accordance with the claimed equations, and the type and size distribution of composite precipitates in achieving improved elongation and hole expandability at the high tensile strengths of the inventive steel. See, the Declaration, Tables A-B and Figs. A-B. Thus, the combination of alloy content ranges, equation constraints on the relative amounts of alloy elements, as well as the size distribution of composite precipitates are critical for the production of the inventive steels having excellent hole expandability and elongation at high tensile strength.

Regarding the claimed composition, the December Office Action states that the composition disclosed by JP'543 overlaps the presently claimed composition, thus establishing a prima facie case of obviousness. December Office Action, page 4. However, at page 5, the Office Action acknowledges that JP'543 does not disclose Al in the claimed range and cites to US'529 for disclosing "all of the major composition ranges disclosed by US'529 overlap the composition ranges of the instant invention and the composition ranges of JP'543." As an initial matter, Applicants respectfully disagree that the composition ranges overlap since US'529 does not disclose Mg, a critical element in JP'543 as well as the present invention.

Regarding the US'529 disclosure of Al, the December Office Action states at page 6 that:

> US'529 teaches adding 0.1-2.0wt% Al in the alloy, which overlaps the claimed 0.08-1.5wt% Al as recited in the instant

> claims 1 and 9. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to apply the proper amount of Al as disclosed by US'529 to the steel of JP'543 evidenced by US'968 because US'529 teaches that proper amount Al, for example from 0.1-2.0wt% or more preferably in the range of 0.5-1.5wt%Al will improve the ductility and hole expandability of the alloy (Fig.2 and Col. 7, lines 60-67 of US' 529).

Applicants respectfully disagree and assert that a person of ordinary skill in the art having read the JP'543 disclosure would have expected that the proposed modification of the JP'543 Mg steel with the US'529 range of Al would in fact be detrimental to the ductility and hole expandability. For example, JP'543 discloses that:

> Al is one of the most important additive elements in the present invention. Al easily forms $MgAl_2O_4$ composite oxides having a spinel structure when Mg is added. $MgAl_2O_4$ composite oxides are a form of the finest oxides among composite oxides of Al_2O_3, SiO_2, MnO, and including MgO and are believed to be effective for making the state of dispersion of the oxides more uniform and finer. For this reason, at the time of punching, fine voids are formed. These suppress the stress concentration and thereby are believed t o have the effect of suppressing the formation of coarse cracks and are believed to have the effect of improvement of the hole expansibility. Due to this, 0.002% or more is added. However, *if the amount of addition increases, the effect of addition of Mg is impaired, so the amount is made 0.07% or less*. In particular, to raise the ratio of the MgAl composite oxides among the composite oxides in the oxides and efficiently achieve greater fineness of oxides, the amount of addition is preferably 0.02% to 0.07%.

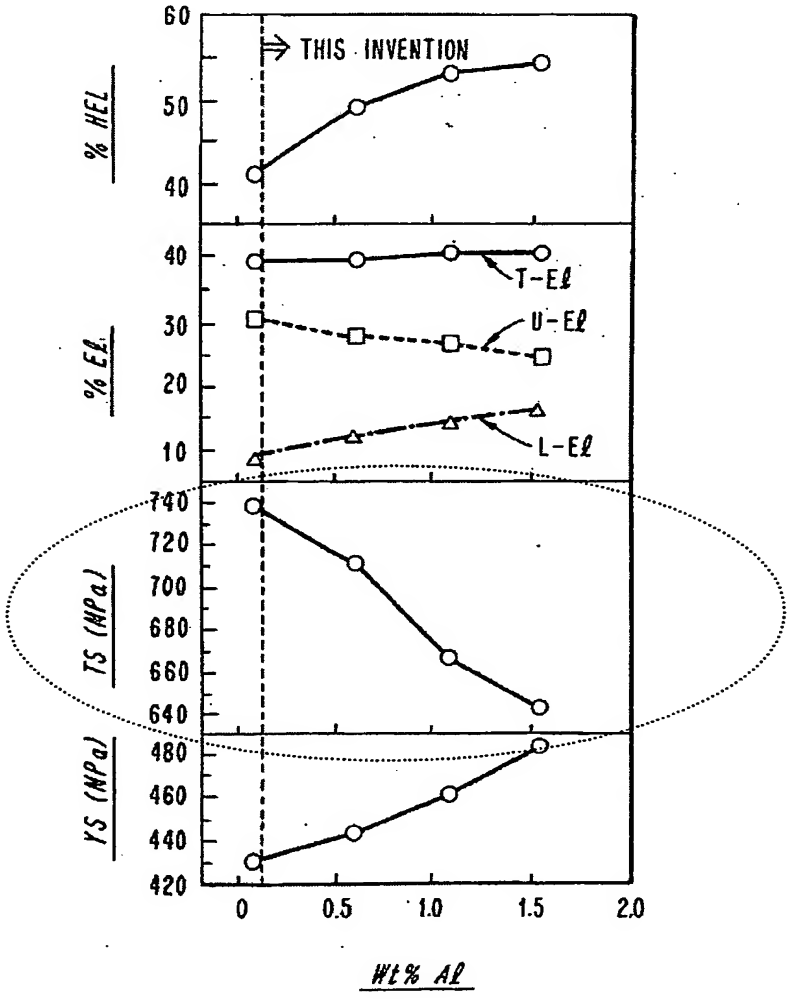
JP'543 at ¶ [0024] of the translation provided with the response filed September 8, 2009, emphasis added. Thus, JP'543 expressly teaches against the addition of Al in an amount greater than 0.07%, and, as such, the JP'543 disclosure *teaches away* from the proposed combination with US'529 for increasing the amount of Al to above 0.07%. It is well settled law that references cannot be combined if one reference expressly teaches against the modification by the combination. *See* M.P.E.P. §2145 X.D.2:

> [i]t is improper to combine references where the references teach away from their combination. *In re Grasselli*, 713 F.2d 731, 743, 218 USPQ 769, 779 (Fed. Cir. 1983) (The claimed catalyst which contained both iron and an alkali metal was not suggested by the combination of a reference which taught the interchangeability of antimony and alkali metal with the same beneficial result, combined with a reference expressly excluding antimony from, and adding iron to, a catalyst.).

Accordingly, Applicants respectfully submit that the Examiner's combination of JP'543 and US'529 is improper.

In addition, the US'529 disclosure itself teaches that increasing the amount of Al decreases tensile strength of its steels. See, US'529 Fig. 2, second chart from the bottom of the page, reproduced below, and at column 5, 32-35.

Fig. 2



Regarding the claimed equations, the December Office Action at pages 6 and 7 states that since JP'543 discloses the same utility throughout the disclosed ranges it would have been obvious to select the claimed compositions of C, Si, Mn, P, S, N, Mg, O, Ti/Nb, and Fe

from the composition disclosed by JP'543.

However, as discussed in the Declaration, the data presented with the application supports that the claimed equations are not general formulae, but are critical constraints on the *relative amounts* of added elements that are not disclosed by the prior art. The claimed formula provide for the production of steels having excellent tensile strength, hole expandability and ductility. As discussed in the Declaration, and above, test data filed with the instant application supports the criticality of the claimed equations. None of the cited references teach or suggest controlling the relative amounts of alloy elements according to the claimed equations or the size distribution and composition of the composite precipitates. As discussed above and in the declaration, both of these features are critical for the production of the inventive steels having excellent hole expandability and elongation at high tensile strength.

Regarding the claimed precipitates, the December Office Action at page 8 further states that:

> [r]egarding the limitation of precipitates of MgO, MgS, and (Nb,Ti)N in the instant claims 1 and 9, JP'543 teaches that steel sheet is characterized by containing between 1.0×10^{3}-1.0×10^{7} pieces/mm^2 of composite precipitates of MgO and (Nb,Ti)N of not smaller than 0.05μm and not larger than 5μm (Claim 2 of JP'543), which overlaps the composite precipitates: 5.0×10^{2}-1.0×10^{7} pieces/mm^2 of MgO, MgS and (Nb,Ti)N of not smaller than 0.05μm and not larger than 3.0μm as recited in the instant claims.

However, as discussed in the Declaration, JP'543 is the only reference that discloses steel sheet containing Mg. Nonetheless, the JP'543 disclosure is limited to MgO inclusions, or combined precipitates such as Al_2O_3, SiO_2, MnO and Ti_2O_3, or combined precipitates surrounded by (Nb, Ti)N, as shown in Fig. F of the Declaration, all of which are quite different from the precipitates of the present invention. More specifically, JP'543 describes that MgO is preferable with one or more complex oxides such as Al_2O_3, SiO_2, MnO and Ti_2O_3. See, JP'543 at ¶ [0027]. Further, Mg and $MgAl_2O_4$ mainly have an effect of form fine voids by means of precipitation of (Nb, Ti)N neighboring those complex oxides, and it is considered MgO and $MgAl_2O_4$ contribute as nuclei for uniform distributed precipitation. See, JP'543 at ¶ [0028].

Regarding the claimed structure, the Examiner acknowledges that JP'543 does not teach the bainite structure required by claim 1. However, the Examiner suggests that the US'968 teaches that microstructure of this kind of steel is controllable and that it would have been obvious to a person of ordinary skill in the art to adjust the microstructure of the JP'543 steel as demonstrated by US'968 and arrive at the presently claimed steel primarily comprising bainite (claim 1) or ferrite+bainite (claim 9) microstructure. For support, the Examiner cites to US'968 teachings of a fine bainite structure having high tensile strength (990-1201 MPa) and hole expandability (hole expanding ratio: 155%-170%), i.e., Samples No. 2-4 and 7 in Table 3 and Samples No. 3,6, 7, and 13 in table 5 of US'968. See, December Office Action at page 4-5.

As shown in the Declaration, the steels of both US'543 and US'968 contain low Al, and teach that increasing Al in their steels has detrimental effects and, on the other hand, the steels of both US'529 and US'968 contain no Mg, which is critical in the steels of the present invention and US'543. Furthermore, as shown in Table C of the declaration, the steels of US'543, US'529, and US'968 all have microstructures different from each other. Applicants assert that combining US'529, US'968, and US'543 in the manner proposed by the Examiner would not provide the steel sheets of the present invention, *i.e.*, having superior hole expandability, elongation, tensile strength, and chemical compatibility.

It can be seen from Fig. C of the Declaration that the hole expandability of the ferrite+bainite steel sheet of the present invention (claim 9) is clearly higher than those of US'543 and US'529. If extrapolated to higher tensile strength according to the linear fit, the hole expandability of the ferrite+bainite steel sheet of the present invention is expected to be higher than those US'968. Similarly, it can be seen from Fig. E that the hole expandability of the ferrite+bainite steel sheet of the present invention (claim 9) are higher than those of US'543 and US'968. If extrapolated to higher elongation according to the linear fit, the hole expandability of the ferrite+bainite steel of the present invention (claim 9) is expected to be higher than those US'529.

On the other hand, Fig. C shows that the hole expandability of the bainite steel sheet of the present invention (claim 1) is comparable to those of US'543 and US'968, even though the bainite steel sheets of the present invention contains a high Al content and better chemical compatibility, and that the bainite steel sheet of the present invention (claim 1) has

significantly higher tensile strength that those of US'529.

Figs. C, D and E also show that the properties such as tensile strength, hole expandability, and elongation of the steel sheets of US'543, US'529, and US'968 are very different from each other, as revealed by different regions in the plots. It cannot be predicted where the properties of a steel sheet formed by combining these references would fall, e.g., whether the properties would fall in the region of US'543, or the region of US'529, or the region of US'968; or a region anywhere in-between or even entirely away.

These comparisons demonstrate that even if the references are combined as proposed by the Examiner, it cannot be predicted that the steel sheets of the present invention can be achieved.

For at least the above reasons, the rejection to claims 1, 9-11, and 19-22 under 35 U.S.C. § 103(a) as being unpatentable over JP'543, US'968 and US'529, either individually or in combination, should be withdrawn.

Conclusion

It is submitted that in view of the present amendment and foregoing remarks, the application is now in condition for allowance. It is therefore respectfully requested that the application, as amended, be allowed and passed for issue.

Respectfully submitted,

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